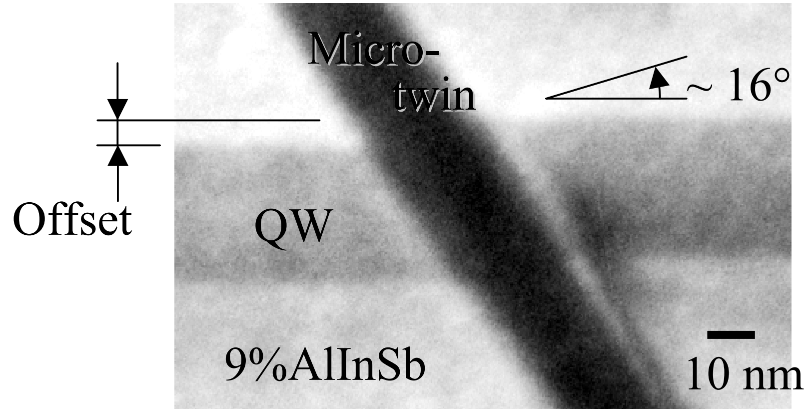
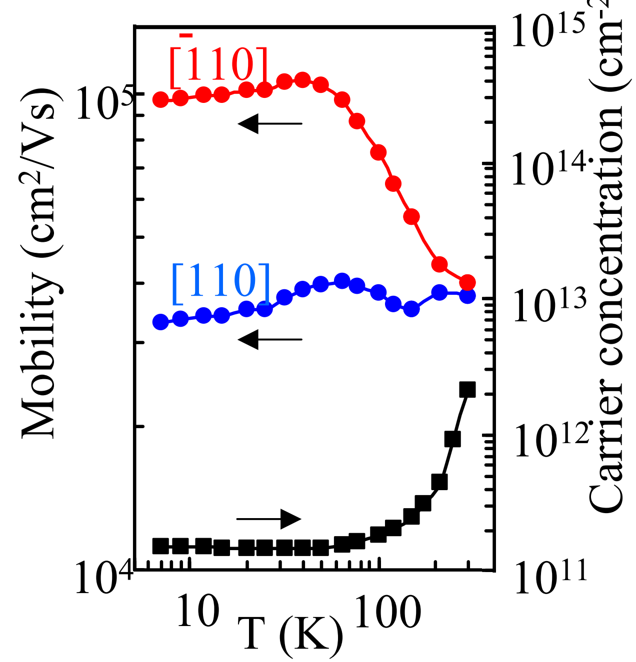
Spin and Other Electronic Properties of InSb Quantum Wells

M.B. Santos, S. Murphy, and R.E. Doezema
University of Oklahoma DMR-0209371

Materials, such as InSb, with properties that depend strongly on electron spin can potentially enable new types of electronic devices. One drawback in using InSb-based structures is that there is no lattice matched III-V insulator to serve as a substrate material. Semi-insulating GaAs is used as a substrate material in spite of its large lattice mismatch, which leads to micro-twin defects in the quantum well. Anisotropy in the low-temperature electron mobility correlates with an anisotropic distribution of micro-twins. We are exploring the effect of buffer layer composition, with the goal of minimizing the defect density.



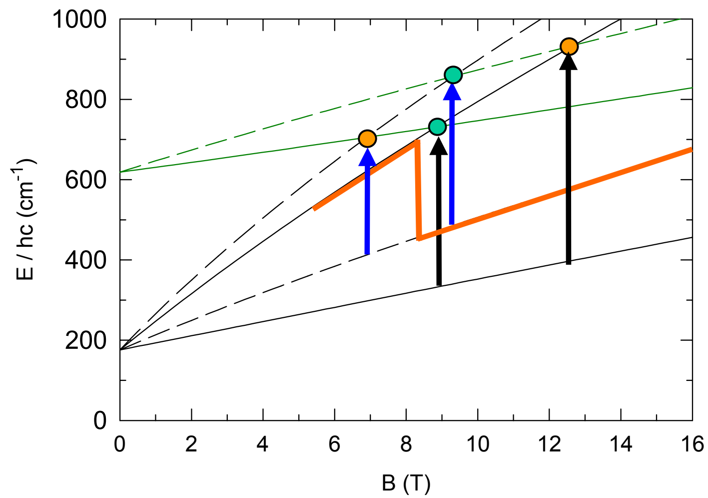
002 DF X-TEM

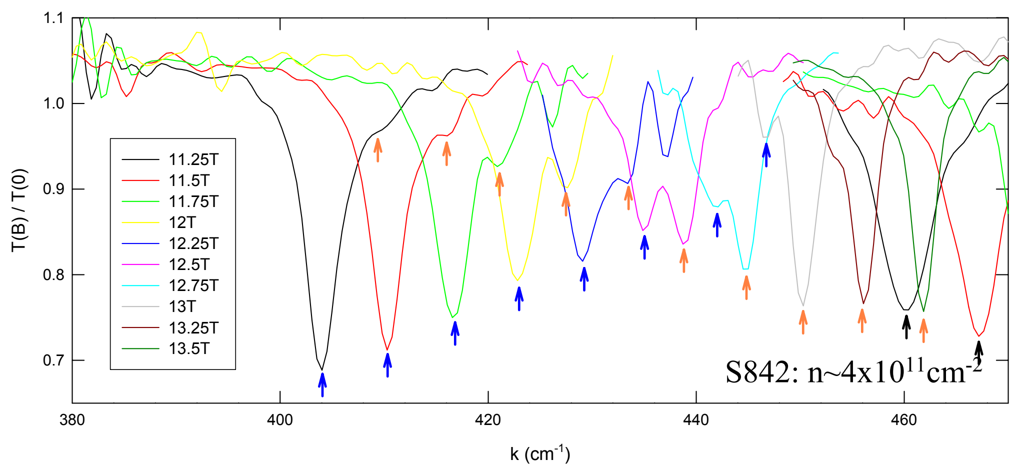


Spin and Other Electronic Properties of InSb Quantum Wells

M.B. Santos, S. Murphy, and R.E. Doezema
University of Oklahoma DMR-0209371

Materials with properties that depend strongly on electron spin can potentially enable new types of electronic devices. Electrons in InSb quantum wells have energies that are sensitive to the direction of the spin when an external magnetic field is applied. We make use of this property to explore the interaction between quantum states of opposite spin. The interaction is probed through spin-conserving transitions induced by far infrared radiation. Understanding of this spin-dependent interaction is an important step toward realizing devices that can manipulate an electron's spin.

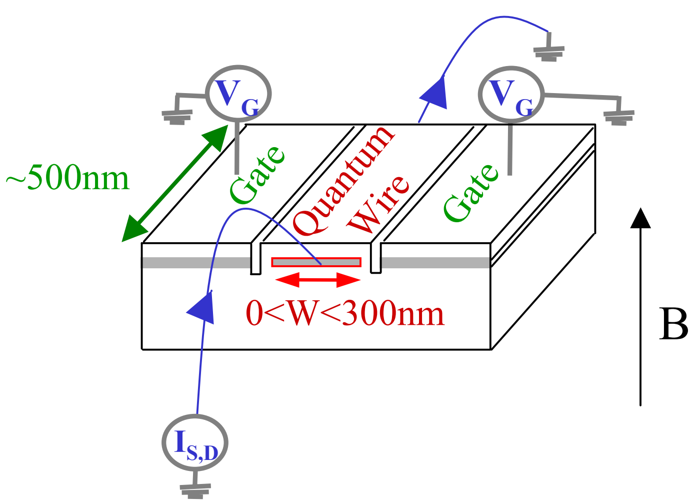


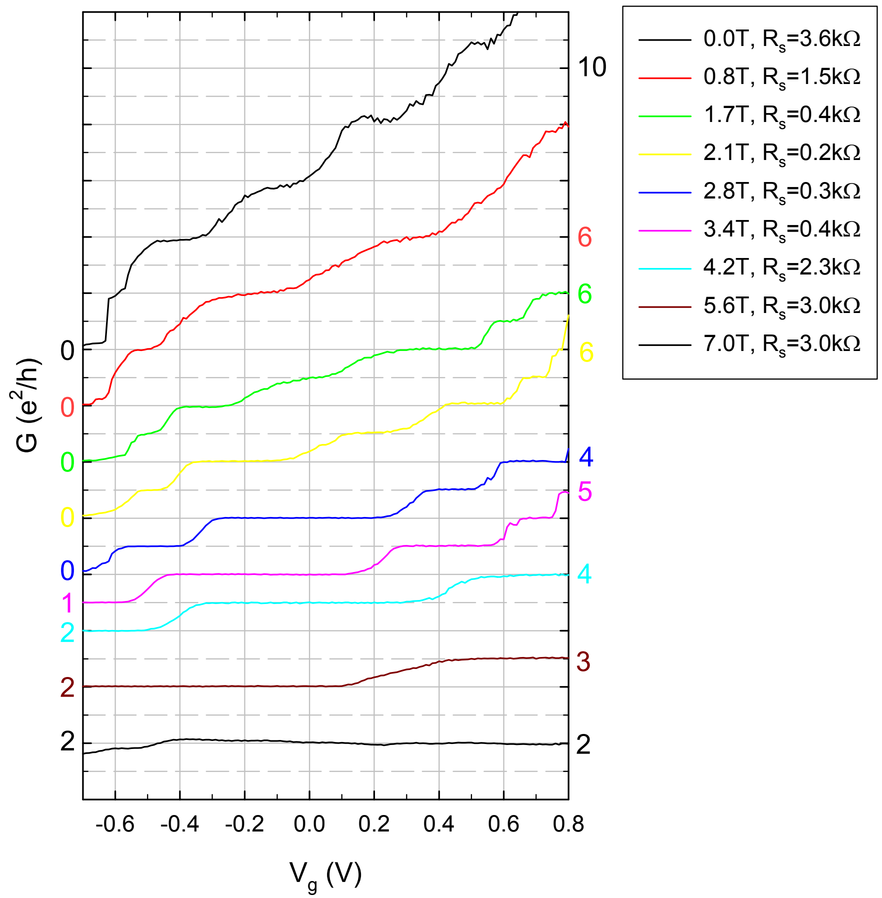


Spin and Other Electronic Properties of InSb Quantum Wells

M.B. Santos, S. Murphy, and R.E. Doezema
University of Oklahoma DMR-0209371

Materials with properties that depend strongly on electron spin can potentially enable new types of electronic devices. InSb quantum wires exhibit a quantized conductance that is sensitive to the spin polarization of the current when a relatively-small external magnetic field is applied. This new result is an important step toward realizing a spin-polarized current source.

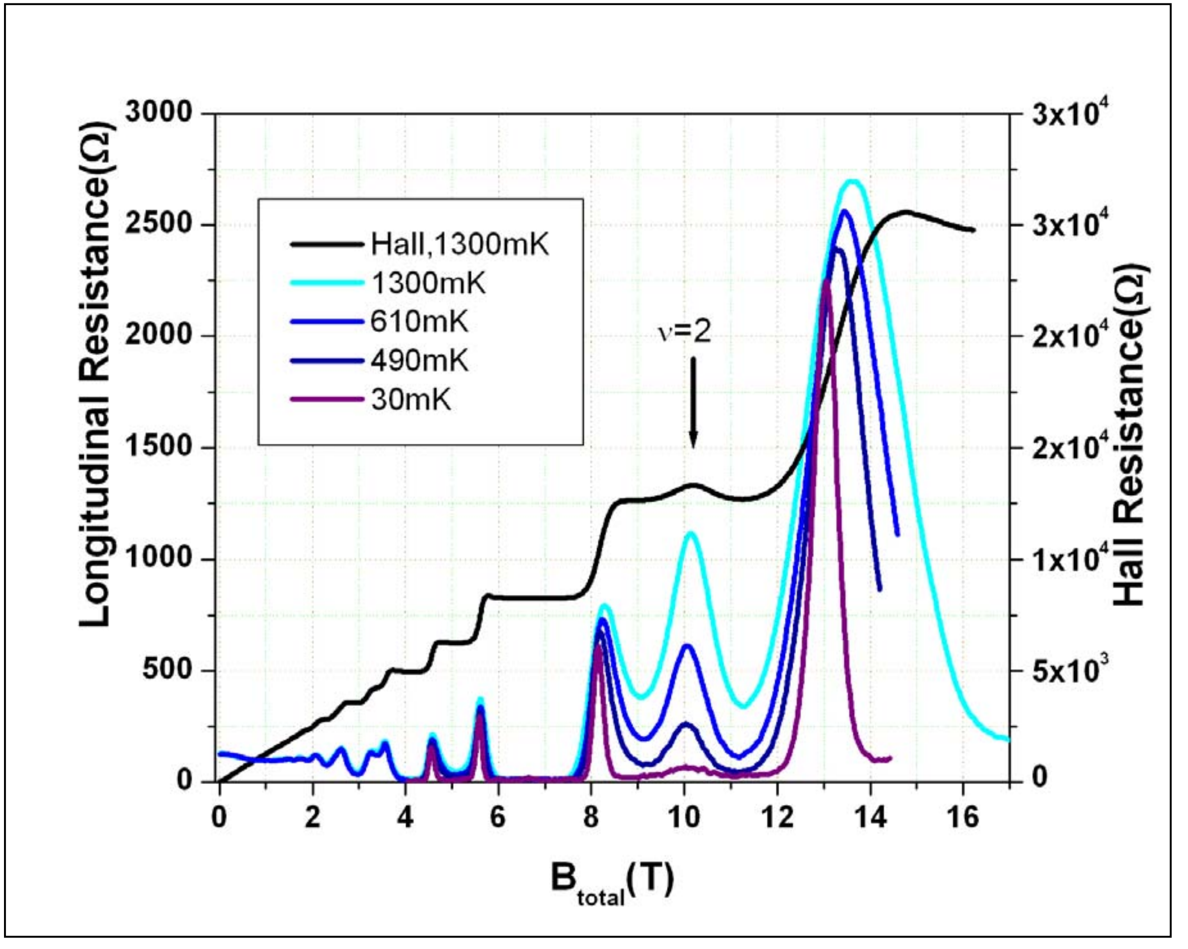




Spin and Other Electronic Properties of InSb Quantum Wells

M.B. Santos, S. Murphy, and R.E. Doezema
University of Oklahoma DMR-0209371

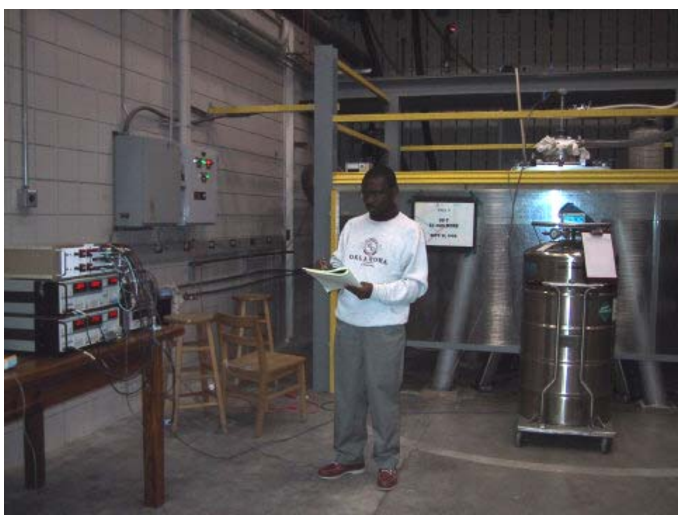
The large g factor of InSb makes possible experiments in which the spin splitting is equivalent to other large energies in the system. In this regime, new many-body states are possible such as quantum Hall ferromagnets.



Spin and Other Electronic Properties of InSb Quantum Wells

M.B. Santos, S. Murphy, and R.E. Doezema
University of Oklahoma DMR-0209371

Education:
Four undergraduates and five graduate students contributed to the research performed during the first year of this grant. In addition to experiments performed on campus, some of the students traveled to the National High Magnetic Field Laboratory (Tallahassee FL) and NTT Basic Research Laboratories (Japan) to perform experiments that required specialized equipment.



Jean-Claude Chokomakoua at NHMFL

Niti Goel at NTT